

**REMARKS**

Claim 13 has been amended to incorporate therein the recitation of claim 19. Claims 18 and 19 have been canceled.

Additionally, claim 13 has been amended to delete the limitation as to a solubility parameter of not smaller than 9.5. This is now recited in new claim 20. New claim 21 finds support, for example, in paragraphs [25], [32], [36] and [92].

Review and reconsideration on the merits are requested.

In response to the rejection under 35 U.S.C. § 112, second paragraph, claim 1 has been amended to delete the language “melt-extruded at a solubility parameter of not smaller than 9.5” considered by the Examiner to be indefinite.

Applicants disagree, noting that the solubility parameter is precisely defined in paragraphs [23] to [26] of the present specification. See also U.S. Patent 6,790,887, showing that solubility parameter (Sp-value) is well known in this field of art.

Applicants now discuss the features of the invention.

**(1) Features of the invention:**

The multi-layer container of this invention has at least one oxygen-absorbing layer and the oxygen-absorbing layer comprises a thermoplastic resin having a gas-barrier property, an oxidizing organic component and a transition metal catalyst. The thermoplastic resin itself maintains the gas-barrier property without being oxidized while the oxidizing organic component is oxidized to trap oxygen. Therefore, the resin composition as a whole exhibits excellent oxygen-absorbing property and gas-barrier property.

In this invention, further, the thermoplastic resin, which is used as a matrix of an oxygen-absorbing layer, having a solubility parameter ( $S_p$  value) of not smaller than 9.5, has a large degree of hydrogen bonding. This makes it possible to obtain an excellent gas shut-off property. Besides the functional group-containing oxidizing organic component such as a polyene exhibits a large affinity to the thermoplastic resin having a large  $S_p$  value due to the presence of the functional group, and favorably disperses in the thermoplastic resin such as the polyamide resin, making it possible to obtain a multi-layer container that is easily worked.

In amended claim 13, an important feature resides in that the thermoplastic resin having a gas-barrier property that serves as a matrix of the oxygen-absorbing layer is not substantially oxidized. In this invention, therefore, a xylylene group-containing polyamide resin is selected having an excellent gas-barrier property from among polyamide resins, the xylylene group-containing polyamide resin having an amino group concentration of not smaller than  $40 \text{ eq}/10^6 \text{ g}$ . As described on page 10, line 16 to page 11, line 1 of the specification, the xylylene group-containing polyamide resin having an amino end group concentration of not smaller than  $40 \text{ eq}/10^6 \text{ g}$  is hardly oxidized, and resists loss of strength or gas-barrier property that stems from deterioration by oxidation. Hence, the specific xylylene group-containing polyamide resin of the invention exhibits an excellent gas-barrier property over extended periods of time even in the presence of a transition metal catalyst.

On the other hand, even the xylylene group-containing polyamide permits oxygen to permeate in large amounts when its amino end group concentration is in a range of 10 to 30

eq/10<sup>6</sup>g as demonstrated in Comparative Example 6 of the present specification. This means that even a xylylene group-containing polyamide resin is degraded by oxidation.

Therefore, use of a xylylene group-containing polyamide resin alone does not exhibit a sufficient degree of barrier property over extended periods of time if its amino end group concentration is smaller than 40 eq/10<sup>6</sup> g. Therefore, an amino end group concentration of not smaller than 40 eq/10<sup>6</sup> is critical for achieving the desired gas-barrier property.

Namely, in the oxygen-absorbing layer of this invention, oxygen is absorbed exclusively by the oxidizing organic component dispersed in the matrix, and the gas-barrier property is achieved by employing a specific xylylene group-containing polyamide resin having an amino end group concentration of not smaller than 40 eq/10<sup>6</sup> g, which is the matrix resin.

**(2) Rejection of claims 13-18 under 35 U.S.C. § 102(b) as anticipated by or, in the alternative, under 35 U.S.C. § 103(a) as obvious over U.S. Patent 6,423,776 to Akkapeddi et al.:**

The Examiner considered Akkapeddi et al as disclosing a polyamide composition for use in producing a multi-layer product, including a resin layer having a composition meeting the terms of the rejected claims.

In response, claim 13 has been amended to incorporate therein the recitation of claim 19, to thereby obviate the rejection. Withdrawal is respectfully requested.

Applicants further comment on the present invention relative to Akkapeddi et al as follows.

As required by amended claim 13, the thermoplastic resin of the oxygen-absorbing layer has been limited to an xylylene group-containing polyamide resin having an amino end group concentration of not smaller than  $40 \text{ eq}/10^6\text{g}$ , which is explicitly different from that of Akkapeddi et al.

Akkapeddi et al surely discloses a composition comprising a polyamide resin, an oxidizing organic component and a transition metal catalyst, and encompasses MXD6 (col. 4, lines 66-67) having a xylylene group as a polyamide resin.

However, Akkapeddi et al do not describe or suggest an amino end group concentration of the xylylene group-containing polyamide. Akkapeddi et al did not recognize the significance of the xylylene group-containing polyamide resin having a particular amino end group concentration which is not deteriorated by oxidation in the presence of a transition metal catalyst and which exhibits a gas-barrier property over extended periods of time.

As described above, further, the amino end group concentration in the xylylene group-containing polyamide resin is critical for preventing a decrease in the gas-barrier property due to deterioration by oxidation of the xylylene group-containing polyamide resin.

**(3) Rejection of claims 13-19 under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent 6,406,766 to Rotter et al.:**

The Examiner considered Rotter et al as disclosing an oxygen scavenging composition, for use in producing a multi-layered container, the composition comprising a polycondensate including polyamide segments and segments from a functionally terminated polydiene and a transesterification catalyst. The Examiner further considered that the cited reference implicitly

suggests that any polyamide can be used with a reasonable expectation of success, such that the limitation to an amino end group concentration of not smaller than  $40 \text{ eq}/10^6 \text{ g}$  is not of patentable significance.

Applicants respectfully traverse for the following reasons.

Initially, as noted by the Examiner, Rotter et al are entirely silent as to the type of polyamide for use in the resin composition, and therefore did not recognize the criticality or effect of amino end group concentration on maintaining the barrier property over extended periods of time. As shown by the comparison of Example 6 (AEG= $87 \text{ eq}/10^6 \text{ g}$ ) and Example 8 (AEG= $52 \text{ eq}/10^6 \text{ g}$ ) with Comparative Example 6 (AEG= $27 \text{ eq}/10^6 \text{ g}$ ), the samples of the invention having an amino end group concentration of not smaller than  $40 \text{ eq}/10^6 \text{ g}$  resulted in remarkably reduced  $\text{O}_2$  permeation as shown in Table 3 at page 41 of the present specification.

Turning to the cited prior art, Rotter et al attempted to incorporate an oxidation reactive unit into a molecular chain of polyester or polyamide by polycondensation or an ester-exchange reaction. Therefore, the fundamental idea of Rotter et al is different from the present invention in which the polyamide is not positively reacted with the oxidizing organic component. However, the Examples surely have common portions (Example 4 of this invention, and Examples 1 and 2 of Rotter et al).

In amended claim 13, however, the thermoplastic resin is limited to a xylylene group-containing polyamide resin having an amino end group concentration of not smaller than  $40 \text{ eq}/10^6 \text{ g}$  (as described in original claim 19). Rotter et al do not at all describe or suggest the amino end group concentration of the xylylene group-containing polyamide resin. For the same

reasons, Rotter et al did not recognize criticality in the amino end group concentration for maintaining good gas-barrier property over long periods of time. Therefore, like Akkapeddi et al, absent Applicants' teachings in the present specification, there is nothing in the cited prior art which would lead or otherwise motivate one of ordinary skill to employ the specific xylylene group-containing polyamide resin having an amino end group concentration of not smaller than  $40 \text{ eq}/10^6 \text{ g}$ , in combination with an organic oxidizing component and a transition metal catalyst, as required by amended claim 13. For the same reasons, there is nothing in the cited prior which teaches the desirability, and hence the unobviousness, of increasing the amino end group concentration to the requisite level to achieve the effects of the invention. This is confirmed by Rotter et al itself which, as acknowledged by the Examiner, is silent relative to the types of polyamides that might be used.

For the above reasons, it is respectfully submitted that the claims as amended herein are patentable over Rotter et al, and withdrawal of the foregoing rejection under 35 U.S.C. § 103(a) is respectfully requested.

**(4) Rejection of claims 13-19 under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-12 of U.S. Patent No. 6,680,094**

The Examiner considered that the present claims were not patentably distinct from the claims of the '094 Patent as containing overlapping subject matter, specifically noting the multi-layered container per claim 8.

AMENDMENT UNDER 37 C.F.R. § 1.111  
U.S. Application No.: 10/802,718

Applicants respectfully request the Examiner to hold the obviousness-type double patenting rejection in abeyance pending indication of allowable subject matter.

In the event that the Examiner believes that it may be helpful to advance the prosecution of this application, the Examiner is invited to contact the undersigned at the local Washington, D.C. telephone number indicated below.

Respectfully submitted,



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WASHINGTON OFFICE

**23373**

CUSTOMER NUMBER

Date: February 23, 2005